Личность как субъект образования на различных этапах жизненного пути и проблемы психологии воспитания

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Security officers for hazardous industrial facilities: Validating a perspective system of job-related psychological selection

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Abstract. Any professional activity centres around a person with his/her individual psychological characteristics and possible deviant behaviour. Armed security officers working at hazardous industrial facilities (HIF) may pose a potential threat. The study aimed to improve the system of job-related psychological selection to identify psychological causes behind offences committed by HIF security officers.

The criteria underpinning new systems of job-related psychological selection have to be valid. Questions of validity may also arise as regards individual psychodiagnostic tests included in the new system.

Professionally important qualities (PIQ) of HIF security officers were identified through a psychographic study and expert interviews with military guards working at critical state facilities. The personality traits identified in those HIF security officers who committed offences were presented as "profiles".

We developed a psychological selection module as the main processing module of the job-related psychological selection system. The module implements basic selection algorithms. The validity of test methods used in the module was assessed in view of their prevalence in traditional approaches to job-related psychological selection of military personnel.

The empirical testing of the psychological selection module was carried out during the recruitment of HIF security officers. The next phase of the study is to complete reliability and criterion validity tests of job-related psychological selection in question.

Keywords: hazardous industrial facility, methodology, professionally important qualities, professional psychological selection, insider model, threat model, psychological reference model, experts.

К вопросу валидности перспективной системы профессионального психологического отбора специалистов по охране опасных производственных объектов

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Аннотация. В центре любой профессиональной деятельности находится человек со своими индивидуальными психологическими характеристиками и, с другой стороны, возможными поведенческими девиациями. Специалист по охране опасного производственного объекта (ОПО) с табельным вооружением, допущенный в различные защищаемые зоны, представляет собой потенциальную угрозу. Целью исследования являлось совершенствование системы профессионального психологического отбора для обеспечения своевременного выявления психологических причин нарушений в служебной деятельности специалистов по охране ОПО и повышения безопасности эксплуатации ОПО. Разрабатывая новые системы профессионального психологического отбора, необходимо помнить об обосновании их критериальной валидности. Вопросы критериальной валидности могут возникать и по отношению к отдельным психодиагностическим тестовым методикам, входящим в новую разработанную систему отбора.

Для объективного выявления профессионально-важных качеств (ПВК) личности специалиста по охране ОПО предложено использование психографического метода. В вышеуказанных целях было проведено психографическое исследование, в рамках которого осуществлен ряд экспертных опросов военнослужащих воинских частей по охране важных государственных объектов. Выделенные на основании работы экспертов характерные свойства личности внутренних нарушителей в лице специалистов по охране ОПО были представлены в виде «профилей».

Разработан модуль психологического отбора, который является основным обрабатывающим модулем системы профессионального психологического отбора и реализует основной алгоритм проведения профессионального отбора. В части оценки критерия валидности при подборе тестовых методик для использования в модуле отмечена их распространенность в традиционных подходах к осуществлению профессионального психологического отбора военнослужащих.

Проведение эмпирической апробации модуля психологического отбора проводилось в ходе мероприятий по приему на военную службу по контракту в воинских частях по охране важных государственных объектов. Разработанная система позволяет осуществлять комплекс мероприятий профессионального психологического отбора специалистов по охране ОПО. При разработке данной системы за основу был взят передовой опыт организации службы по охране важных государственных объектов. Отмечена важность завершения исследования надежности и валидности данного метода проведения профессионального психологического отбора.

Ключевые слова: опасный производственный объект, методика, профессионально важные качества, профессиональный психологический отбор, модель внутреннего нарушителя, модель угроз, психологический эталон, эксперты.

Introduction

Any professional activity centres around a person with his/her individual psychological characteristics and possible deviant behaviour. It is a very serious issue for jobs related to the use of service weapons. This is where an effective job-related psychological selection system may help to identify risk factors and exclude unreliable candidates from the selection process. In general, job-related psychological selection

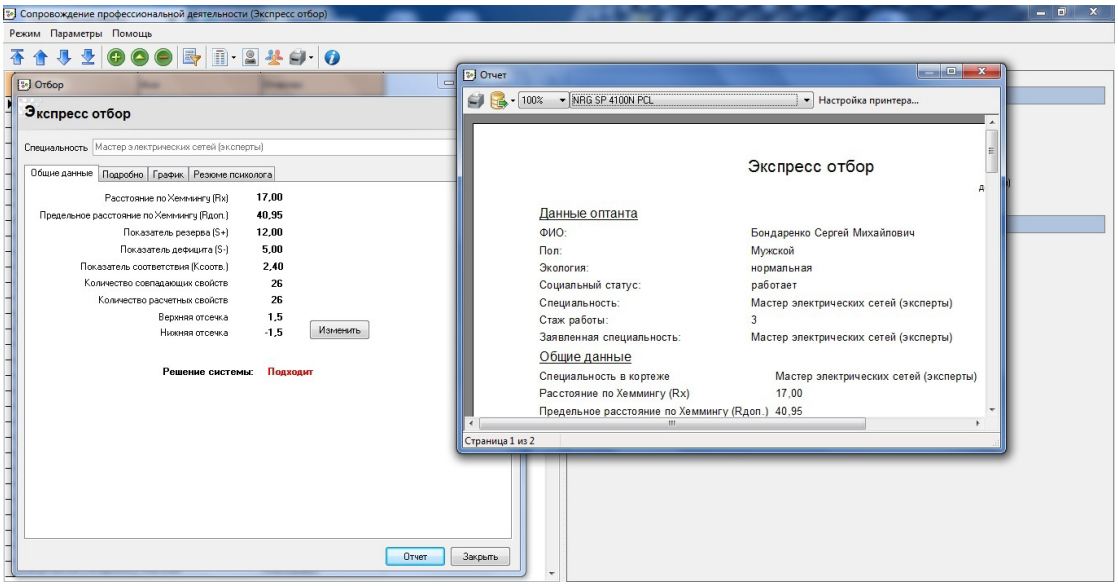

Fig. 1. ASPSA software dialog box

is a set of measures to ensure efficient selection of candidates by assessing individual psychological and psychophysiological traits.

Nuclear power is one of the priority areas for Russian science and industry. Hence, it is necessary to eliminate / minimize all the risks associated with the use of nuclear energy (for workers, nearby settlements and even remote areas), to manage security threats, etc.

One of the potential threats is an armed HIF security officer who may access a range of protected areas. In view of the above, the systems of job-related psychological selection of HIF personnel require high-quality mathematical, informational, algorithmic and other support, including the use of appropriate automated systems. At the same time, the development of these systems should be guided by the results of a preliminary analysis of threats, one way or another related to human factor (Ko, Divakaran, Liau, Thing 2016).

The foregoing necessitated the development of a new promising system of job-related psychological selection and its integration as a supporting subsystem in a single HIF management system (Andreevsky, Akhmedkhanov, Daneykin 2015). With the above in mind, new systems of job-related psychological selection (SJPS) have to be based on valid criteria. Questions of validity may also arise as regards individual psychodiagnostic tests included in the new system.

The present study is based on seminal works by Russian and international scholars, including B. G. Ananiev, V. A. Bodrov, K. M. Gurevich, E. A. Klimov, N. D. Levitov, F. W. Taylor, B. M. Teplov, A. Fayol, V. D. Shadrikov, and others (Lisnik, Gornostaev 2020).

At the moment, consolidated research focusing on the relationship between individual psychological traits and risk factors is lacking. As a consequence, if risk factors are identified inaccurately, a psychologist may decide that the candidate is prone to deviant or destructive behavior. Modern theories of deviant and/or destructive behavior claim that such behavior manifests itself when an individual has a set of specific psychological traits. Hence, job-related selection will benefit from, first, determining such specific traits and, second, from establishing the level at which they correlate with the manifestation of deviant behavior (Zlokazov, Vlasov 2019).

International studies in job-related selection focus on the selection of candidates for police service. See, for example, the works by M. L. Dantzker and J. H. McCoy (Dantzker, McCoy 2006).

The hypothesis of the study is the assumption that some candidates should be denied employment as HIF security officers due to their individual psychological risk factors.

The study aimed to improve the system of job-related psychological selection through duly identification of psychological causes behind offences committed by HIF security officers resulting in an improved HIV operational security.

The objective of the study was to find the ways to substantiate the validity of the developed system of job-related psychological selection.

Methodology

We used the psychographic method of T. Zinchenko and A. Frumkin (Zinchenko, Frumkin, Vinokurov 1999) to identify professionally important qualities (PIQ) of an HIF security officer.

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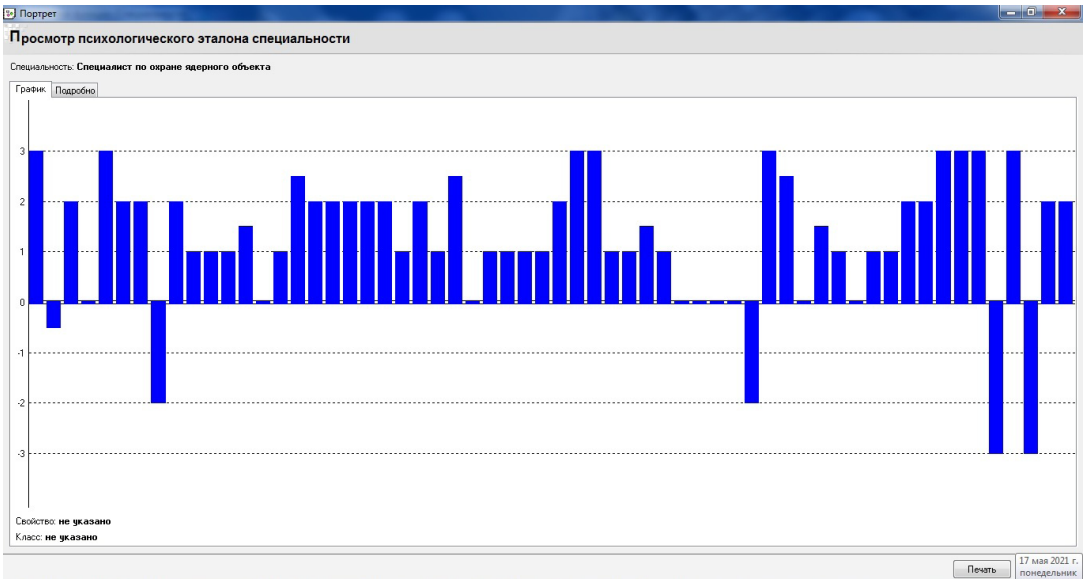

Fig. 2. Psychological reference model of an HIF security officer

The psychographic method has proved its effectiveness in solving various practical tasks. We also used the software package Automated System of Psychological Support of Activities (ASPSA).

Professionally important qualities (PIQ) of HIF security officers were identified through a psychographic study and expert interviews.

To make the assessment more objective, the expert group included employees directly involved in security issues (security staff and inspection staff) and managerial personnel (commanders).

The pool of experts was supposed to be able to assess the relevance of a particular psychological trait for security jobs. Besides, the experts were chosen so that they could "level out" individual deviations of estimates from the average values when assessing the psychological traits of prospective security officers (Deulin, Alekseev 2020).

A group of fifty people included male security officers aged from 18 to 27 with different educational backgrounds (secondary / higher education) and different work experience. All of them successfully passed the final annual assessment (score no lower than 4), had no disciplinary sanctions, medical contraindications or criminal record. They also showed a high level of personal safety and security culture (knowledge and strict adherence to safety and security requirements). The qualitative composition of the pool of experts was based on their professional and personal qualities, professional knowledge, and motivation to participate in the study. The experts were selected with the documentary method (formal social and professional indicators as well as documentary sources, e.g., performance reports, personal files, etc.), a method of consolidating independent feedback (selection of experts based on summing up independent opinions about their professional qualities given by colleagues) as well as recommendations provided by the commanders of military units (Andreevsky, Akhmedkhanov, Gubin 2015).

To obtain expert assessments, a single psychographic questionnaire with a list of PIQ was used. The experts were asked to evaluate an employee's competencies listed in the questionnaire from professionally important (3 points) to unacceptable (–3 points). These data were used to develop a psychological reference model (a list of psychological traits which determine the effectiveness of professional activity) of an HIF security officer and to determine the most significant PIQ.

The software package ASPSA was used. The reference model was used to select the most significant as well as unacceptable PIQ (the traits that received above 2.5 or below 2.5 points) for the specified category of security officers. The PIQ were evaluated using ASPSA psychodiagnostic methods. This toolkit allowed to assess the compliance of a candidate's psychological characteristics with the required PIQ.

To check the list of PIQ and unacceptable traits for a prospective HIF security officer, the full list of PIQ from the questionnaire was supplemented with the following items: "compliance with the job-related PIQ requirements", "suicidal risks", "alcohol addiction", "drug addiction", "propensity to commit murder", "propensity to commit acquisitive crimes", "propensity to theft", "safety and security culture" (Akhrimenko 2017; Zlokazov, Vlasov 2019).

Practical experience shows that technical measures alone do not provide the required level of safety and security at hazardous facilities. The role of human factor at an HIF is extremely high. HIF personnel constantly interact with mechanical

engineers and make operational managerial decisions. At the same time, HIF personnel are supposed to perform security functions consciously and feel that providing security is their internal personal need (Geraskin, Krasnoborodko, Glebov, Piskureva 2015).

According to the studies conducted in the 1990s–2000s by Russian forensic psychologists, terrorists (extremists) do not constitute a specific diagnostic or psychiatric group, nevertheless, people with a specific personality predisposition are more likely to become terrorists (extremists) (Rutic 2016). The examination of individuals accused of terrorism (extremism) showed that they tend to be aggressive, see others as a constant source of threat, have rigid emotions and experiences that persist after the cause has disappeared, and have low emotional stability. These conclusions became the basis of the "Extremist" offender profile. The PIQ list already had such items as "aggressiveness" and "emotional stability". "Rigidity" was included into the list additionally.

Criminologists from the Ministry of Internal Affairs of Russia (Yu. Antonyan, M. Yenikeev, V. Eminov and other high-profile experts with relevant expertise) studied the groups of individuals who committed similar crimes. The study used the method of multilateral personality research (MMPI) and focused on the combination of various indicators (MMPI profile). The study identified characteristic profiles of criminals who committed murder, rape, hooliganism, theft, robbery, burglary, and caused grievous bodily harm (Antonyan, Enikeev, Eminov 1996).

The personality traits of those committing crimes at HIF were identified with the help of experts. Then the identified traits were structured as "profiles".

A match coefficient K ($0 < K < 1$) was introduced. It showed the degree to which the profile of the tested candidate matches the offender profile. The similarity rate is high when $K > 0.8$.

To make the experiment more objective, the data obtained as a result of psychographic research was subjected to mathematical and statistical analysis. By outputting the coefficients of the linear regression equation in Excel, a formula was obtained to assess the correspondence of psychological characteristics to the required PIQ. Linear regression equation is written as $Y = a_0 + a_1 * X_1 + ... + a_n * X_n$, where Y is an indicator of effective professional performance of a candidate (Andreevsky, Paderno 2020). The values of the coefficients of the linear regression equation are shown in Table.

Similar systems are used by numerous law enforcement agencies. According to the results of the testing, candidates were divided into four categories of professional suitability depending on the PIQ values and the presence of threat factors (the similarity of the candidate's profile with one or more of the offender profiles).

The developed system (SJPS) can find application as an effective tool to identify potential offenders among the candidates for HIF security jobs. It may also be used to assess the reliability of the already working HIF personnel.

The SJPS is a distributed, client-server corporate automated decision support system. To effectively implement the threat-eliminating algorithms described above, the popular software environment Microsoft Visual Studio 2010 was chosen.

Uninterrupted communication with databases requires a lot of system resources. To solve this issue, it was proposed to establish the connection

Table. The values of coefficients of the linear regression equation

Variable	Variable value	Coefficient	Coefficient value
		a_0	1,312553
X_1	Concentration of attention	a_1	0,037207
X_2	Stability of attention	a_2	0,024459
X_3	Nervous system strength	a_3	0,039097
X_4	Nervous system lability	a_4	0,029767
X_5	Visual performance	a_5	0,047399
X_6	Speech properties	a_6	0,042046
X_7	Responsibility	a_7	0,040509
X_8	Emotional stability	a_8	0,006654
X_9	Adaptive potential	a_9	0,101077
X_{10}	Aggressiveness	a_{10}	–0,05662
X_{11}	Conflictness	a_{11}	–0,05047

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only for the time necessary to work with the database (disconnected data access).

Psychological selection module Psy_otbor is the main processing module of the SJPS. It implements the main algorithm for professional selection. The primary data for the Psy_otbor module are the results of the candidate's psychodiagnostic testing.

First, the module uses the Hamming formula to determine the compliance of the candidate's PIQ with the requirements (Frumkin 2014). This stage includes the following steps:

1) The results of testing (assessment) for each of the most significant PIQ are introduced.
2) The median values of the estimations for each PIQ are calculated, the number of non-zero median values is calculated.
3) The sum of the modules of differences between the corresponding reference and median values of the PIQ estimations is found.
4) The critical Hamming distance is calculated.
5) The sum of the absolute values of differences between the corresponding reference and median values of the PIQ estimations is compared with the Hamming critical distance.

If the sum of the modules exceeds the critical distance, it is concluded that the candidate's PIQ does not meet the requirements and vice versa.

At the second stage of its operation the Psy_otbor module checks the psychological profile of the candidate for characteristic features of an offender posing a threat to the HIF security.

The second stage comprises the following:

1) Test results (by parameters: PIQ; attentiveness; safety and security culture; emotional stability; neuropsychic stability; suicidal risks; propensity to commit murder; propensity to commit acquisitive crimes; propensity to theft; courage; alcohol addiction; drug addiction; rigidity) are introduced on a 10-point scale to build a psychological profile.
2) The program calculates the coefficient K_i (in fractions of one). It shows the degree to which the profile of the tested candidate matches the profile of the offender. If $K_i > 0.8$, a conclusion is made about a high degree of similarity and unsuitability of the candidate.

This approach (and the value of the coefficient) has proved to be valid during the successful testing of the psychological selection module.

During the third stage of its operational cycle the Psy_otbor module provides a detailed interpretation of test results.

The validity is one of the most important criteria for assessing the quality of a test, ranking second after reliability. By itself, the question of testing the validity is considered as one of the most difficult. Validity should indicate how well the test is doing what it was designed to do. It is commonly considered to classify validity by content, construct validity, criteria (current and predictive), validity by distribution, by discriminative ability (Rupp, Pant 2007).

There is no common approach to determining validity. The method of verification will depend on the type of validity chosen by the researcher. In other words, validity is a complex concept that embraces several types of validity each with its own special meaning. Checking the validity of a test method is called validation. The validity of psychological tests reflects the correspondence of their results to the essence of the measured psychological phenomena.

There are two main ways to determine the validity of psychological tests.

The first way is to compare the test results with similar indicators produced by other tests. For example, to check the validity of a self-assessment test, you can do the following:

- use a new test on a sample of individuals;
- reveal how the sample of individuals assessed themselves in a different test (it is assumed that the different test is valid);
- calculate the correlation of self-esteem indicators using the two psychodiagnostic techniques;
- a statistically significant correlation will imply that the new test is valid.

This method is used to identify the so-called construct validity. It reflects the correspondence of the revealed psychological indicator to the psychological construct.

The second way to identify the validity of a psychological test is to compare the test results with external criteria. This type of validity is called the criterion validity of a psychological test.

For example, an indicator of the criterion validity of a test for deviant behavior is an actual number of juvenile delinquency cases. With regard to the achievement motivation test, an indicator of criterion validity is effectiveness of a particular activity.

The reliability of the test reflects its quality as a diagnostic method. Here, we mean formal indicators only and do not take into account the meaningful analysis of the results.

These are the meaningful test results that measure validity, i. e., how much the test results correspond to real psychological phenomena.

A reliable test is not necessarily valid. For example, a test of initiative can show high retest reliability and consistency of parts. However, from a meaningful

point of view, the test results do not reflect so much initiative, rather, they reflect willpower. That is, the reliability of this test is high, but the validity is low.

The validity of psychological tests is usually verified through the comparison of obtained scores with the results of other tests that measure similar psychological phenomena.

The validity of test methods used in present research is based on the prevalence of such methods in traditional job-related psychological selection of military personnel. For example, a multi-level personal questionnaire "Adaptability" by A. Maklakov and S. Chermyanin (Raigorodsky 2006) is used to assess some psychophysiological and socio-psychological characteristics that reflect mental and social development of candidates for the admission to volunteer military service. The scales of the 1st level of the "Adaptability" questionnaire are independent and correspond to the basic scales of MMPI. They allow to obtain typological characteristics of a person and determine their character accentuations. Forensic researchers of the Ministry of Internal Affairs of Russia conducted an extensive study of the possibility of using such scales to assess the propensity to commit, e.g., acquisitive crimes, theft, etc. (Antonyan, Enikeev, Eminov 1996).

Throughout the study, the validity of the psychological selection module is subject to monitoring. Overall validity is ensured by research standards as well as validity and wide applicability of basic psychodiagnostic techniques used in the research and in the development of the module. The study will also use assessments provided by the group of experts with first-hand experience of working with HIF security officers selected using the new model. The results of the study will be published once the study is over.

Results and discussion

The SJPS module of psychological selection was tested during the selection of volunteer military recruits to serve in military units protecting critical state facilities.

The module has proved to be effective for use by workers with little relevant work experience (HR managers without a degree in psychology, or those with 6 to 12 months of work experience).

The automated testing saved time and labor costs on the examination of military personnel compared to the manual processing of the results of psychodiagnostic tests. On average, it takes an hour and a half time to manually processes the tests results and draft a report on professional suitability. The automated selection with the help of the psychological module reduced this time to thirty minutes.

The empirical testing has revealed some trends.

The number of volunteer military service recruits has increased. This trend may be the result of the unfavorable social and economic conditions in the region and the country as a whole, the prestige of military service, and related social benefits (Shaimova 2019).

The analysis of the obtained qualitative characteristics of job-related selection showed that the number of candidates recommended for acceptance in the early stages of recruitment process has decreased (from 9% to 6%), while there was a sharp increase in the number of candidates not recommended for acceptance (from 2% to 11%).

It should be remembered that candidates from category 4 of professional suitability may still show some factors of threat. Thus, when this category is screened out, a scheme for managing threats of unauthorized actions by HIF security officers is implemented.

The tendency for the deterioration of indicators in category 1 and 4 in terms of professional aptitude can also be caused by the use of the psychological selection module, which contains more stringent selection algorithms compared to common psychodiagnostic tools.

In 2021 we summarized the results of the study (use) of the SJPS psychological selection module by the students of a military education institution (specialization 37.05.02—Psychology of Service Activity). They used the module in their studies and research. The results were also compared with those obtained by traditional selection systems.

So far, there have been no offenders among those HIF security officers who took part in the experiment.

The SJPS is supposed to be validated by establishing the validity of its selection criteria. The validity of the test will be confirmed through its comparison with some external criterion. For this purpose, a comprehensive external criterion was selected, i.e., effective performance of duties, score no lower than 4 for the final annual assessment, absence of disciplinary penalties, violations of safety and security culture, administrative fines or convictions. Once the criterion validity study is completed, the results will be published in an article.

Conclusion

The designed system (SJPS) offers a set of measures to conduct job-related psychological selection of HIF security officers. The system embraces advanced practices and experience in organizing protection of critical state facilities.

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This system, with certain limitations, allows both in-house and external HR personnel to access detailed information about candidates and already employed HIF security officers. The tool is a contribution to the development of professional psychological selection systems used in various state-run organisations.

The empirical testing of the SJPS module of psychological selection was a success. The testing was carried out at an HIF in real operational conditions. The next phase of the study in the job-related psychological selection is to complete the reliability and criterion validity tests.

Conflict of interest

The members of the author team are not parties to any conflict of interest.

Author contributions

All the members of the author team made an equal contribution to the publication.

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